

科目：生物化學 適用：應化所

編號：445

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

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Short Answering Questions: (100%, total 10 questions)

1. True (T) or false (F): (2% each, total 24%)

- (a) A major component of RNA but not of DNA is uracil.
- (b) The coenzyme involved in a transaminase reaction is pyridoxal phosphate (PLP).
- (c) Movement of water across membranes is facilitated by aquaporins.
- (d) A ribosome is the complex within which protein synthesis occurs.
- (e) The products of the β oxidation of fatty acids can directly enter the citric acid cycle for further oxidation.
- (f) Some membrane proteins covalently attach to lipid moieties, and some covalently attach to carbohydrate moieties.
- (g) The light reactions in photosynthetic higher plants do not require chlorophyll.
- (h) Eukaryotic RNA polymerases initiate transcription at specific sites on the DNA (promoters), but prokaryotic polymerases do not.
- (i) Chargaff's rules state that $A + T = G + C$ in typical DNA.
- (j) Restriction enzymes are specific proteases that cleave peptides at only certain sequences.
- (k) Introns contain base sequences that code for unusual amino acid sequences in proteins.
- (l) Nonessential amino acids are synthesized by plants and bacteria, but not by humans.

2. The synthetic compound mevinolinic acid, also called lovastatin, is a potent competitive inhibitor of HMG-CoA reductase (hydroxymethylglutaryl-CoA reductase). Predict and explain the effect of this drug on serum cholesterol levels in humans. (6%)

3. Describe the quaternary structure of hemoglobin (6%), and explain how CO_2 and H^+ regulate its binding of O_2 (4%).

4. Draw a graph of v_0 versus $[S]$ for a typical enzyme reaction with properly labeling of V_{\max} and K_m in the absence of an inhibitor (2%), in the presence of a competitive inhibitor (3%), and in the presence of a noncompetitive inhibitor (3%).

5. Amylose, glycogen, and cellulose are the common polymeric forms of D-glucose. Compare their linkages (6%) and explain why human cannot metabolize cellulose, but ruminants do (4%).

6. Draw a diagram to show how glucose is transported into intestinal cells by coupling with Na^+/K^+ ATPase system, and indicate which is primary active transport, and which is secondary active transport (10%).

7. As you write this exam, you are (presumably) consuming oxygen. What single reaction accounts for most of your oxygen consumption? (6%)

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8. How many ATP are produced from one glucose in the net reaction of glycolysis? (2%) Draw a scheme to show three major fates of the final product of glycolysis. (8%)
9. During starvation, more urea production is produced. Why? Explain in 50 words or less. (6%)
10. The tripeptide glutathione (GSH, γ -Glu-Cys-Gly) serves a protective function in animals by destroying toxic peroxides that are generated during aerobic metabolic processes.
- (a) Name glutathione by the one-letter abbreviations of amino acids. Note: γ -Glu-Cys-Gly is named by the three-letter abbreviations of amino acids. (3%)
- (b) Draw the chemical structure of glutathione. Note: the γ symbol indicated that the peptide bond between Glu and Cys is formed between the γ -carboxyl of Glu and the amino group of Cys. (7%)

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